

# THE NATIONAL COASTAL PLAN: FIRST BIOSEDIMENTOLOGICAL RESULTS IN A TEST AREA IN THE LIGURIAN SEA (NW ITALY)

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## Abstract

Within the context of the Italian Coastal Plan, bio-sedimentological aspects have been studied in a coastal area with relevant erosion problems. Sediments, *Cymodocea nodosa* meadows and *Sabellaria alveolata* reefs have been sampled and analysed, in order to study the two organisms and their interactions with shorelines evolution. The final aim is to find out possible bio-sedimentological indicators, which could be useful in the understanding of coastal dynamics and marine ecosystems, therefore giving guidelines in coastal management.

**Key-words:** coastal management, bio-indicators, erosion, geomorphology, shoreline evolution

## Introduction

The Marine Environment Research Centre ENEA S.Teresa and the Italian Ministry of Environment are working on a 3-year project for a National Coastal Plan, with the leading idea of the sustainable use of coastal resources, in order to give guidelines on integrated coastal management.

On a local scale, a test area has been chosen in the NW Mediterranean (Eastern Ligurian Sea, Tigullio Gulf) for its relevant ecological value (being partially a Marine Protected Area), strictly close to an area greatly affected by tourism, where two marinas (Chiavari and Lavagna) have been built (Figure 1). The coasts here are scarcely nourished by natural sediment sources and have been protected with hard coastal defence structures.

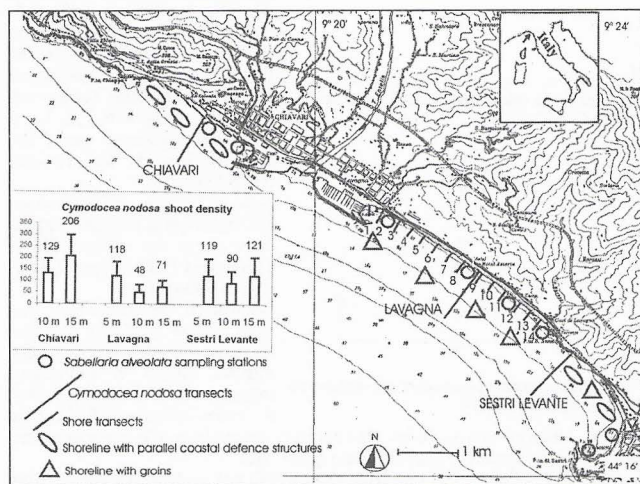


Figure 1. Map of Tigullio Gulf (Ligurian Sea, NW Italy), showing the study area, sampling stations and transects

The aim of the work is to study bio-sedimentological aspects through two organisms that together are thought to be good indicators of the health of a coastal area with high environmental values and at the same time with crucial problems of erosion (1).

*Cymodocea nodosa* and *Sabellaria alveolata*, respectively a seagrass and a polychete annelid, are both extremely important indexes to the status of marine coastal ecosystems. *Sabellaria alveolata* forms biogenic reefs between 2 and 7 m depth on low-standing rocks (2, 3), while *Cymodocea nodosa* mainly colonises the seafloor from 5 to 15 m depth on sand (4, 5). The organisms' responses to sediment characteristics and shoreline evolution are the basis of the present research.

## Methods

The following activities and analyses were carried out within summer 2000:

> Sea-bottom sediment samples and phenological parameters (cover, leaf length and width, leaf area index, percentages of broken and dead leaves, coefficient A) of *Cymodocea nodosa* meadows were determined along three transects (Chiavari, Lavagna and Sestri Levante) at 5, 10 and 15 m depth;

> Samples of *Sabellaria alveolata* reefs and sea-bottom sediment samples below them (around 3.5 m) were studied through granulometric, mineralogical and calcymetric analyses;

> Geomorpho-sedimentological surveys on shorelines (14 transects) were focused in the area from Lavagna's harbour to Sestri Levante.

## Results and conclusions

Data and results from shoreline surveys have pointed out how hard coastal defence structures, especially groins, have greatly changed the natural coastal dynamics. The most critical shores to the erosion phenomena have been localised (transects number 4, 5, 6) and measured (only 10-15 m long while the adjacent beaches are around 30 m long). The main causes for this situation are thought to be the seawall that keeps the railway line (running along the beaches) safe from sea storms, but induces a high wave reflection process. The area orientation, down-drift Lavagna harbour, makes it extremely opened and sensible to both SE and SW seas (6).

The critical aspect of Lavagna's area given out from shoreline evolution surveys has been confirmed by the biological results from *Cymodocea nodosa* transect. Despite the homogeneity of sediment distribution (very fine to fine sand) within *Cymodocea nodosa* meadows, the seagrasses along Lavagna transect are characterised by the lowest values of shoot density (see histograms on Figure 1) and cover. In that area, the "Coefficient A", which gives an estimation of percentages of broken leaves mainly caused by water movement, has the highest values. Together with the hard coastal defence structures, the strong hydrodynamics seems to be one of the most stressful factor acting on Lavagna area.

*Sabellaria alveolata* reefs are made by organically cemented sand-tubes, inhabited by the worm itself.

This polychete makes a selection among sediments with different grain sizes, generally using coarse sand with mean size between 2 and 4 mm. On the contrary, no relevant differences have been found in mineralogical compositions between the substratum and the sediment used for tube construction.

*Sabellaria alveolata* has not been found on the western side of the area (Chiavari), where few coastal defence structures are positioned parallel to the shore, making the seawater stagnant behind them even with a rough sea. Largest reefs are built in areas subjected to strong hydrodynamics, suggesting that *Sabellaria alveolata* may take advantage from the highest re-suspension of sediments.

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